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A47L 5/26

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GB 2154432 A EP 0338780 A

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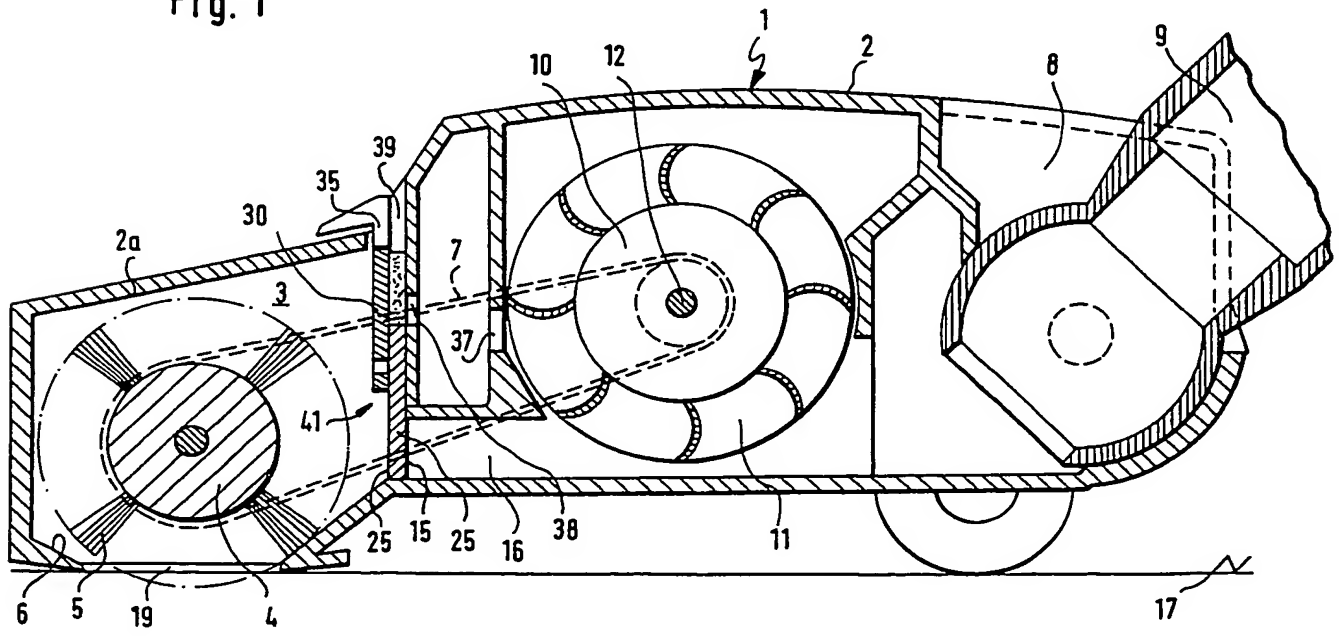
UK CL (Edition K) A4F
INT CL[5] A47L

(54) Vacuum cleaner with adjustable intake air flow

(57) The cleaner (1) has a housing (2), in the base (6) of which is provided an intake opening (19). Disposed above the intake opening (19) is a brush roller (4), bristles (5) of which extend through the intake opening (19). The brush roller (4) is driven by an air turbine (10) that is driven by the intake air flow. To adjust the intensity of the intake air flow, which flows from the intake opening (19) to the air turbine (10) and to a connector (9) of the vacuum cleaner via a flow opening (15), at least one slide mechanism (41) is disposed in the housing (2) for varying the passage cross-section of this flow opening (15).

Fig. 1



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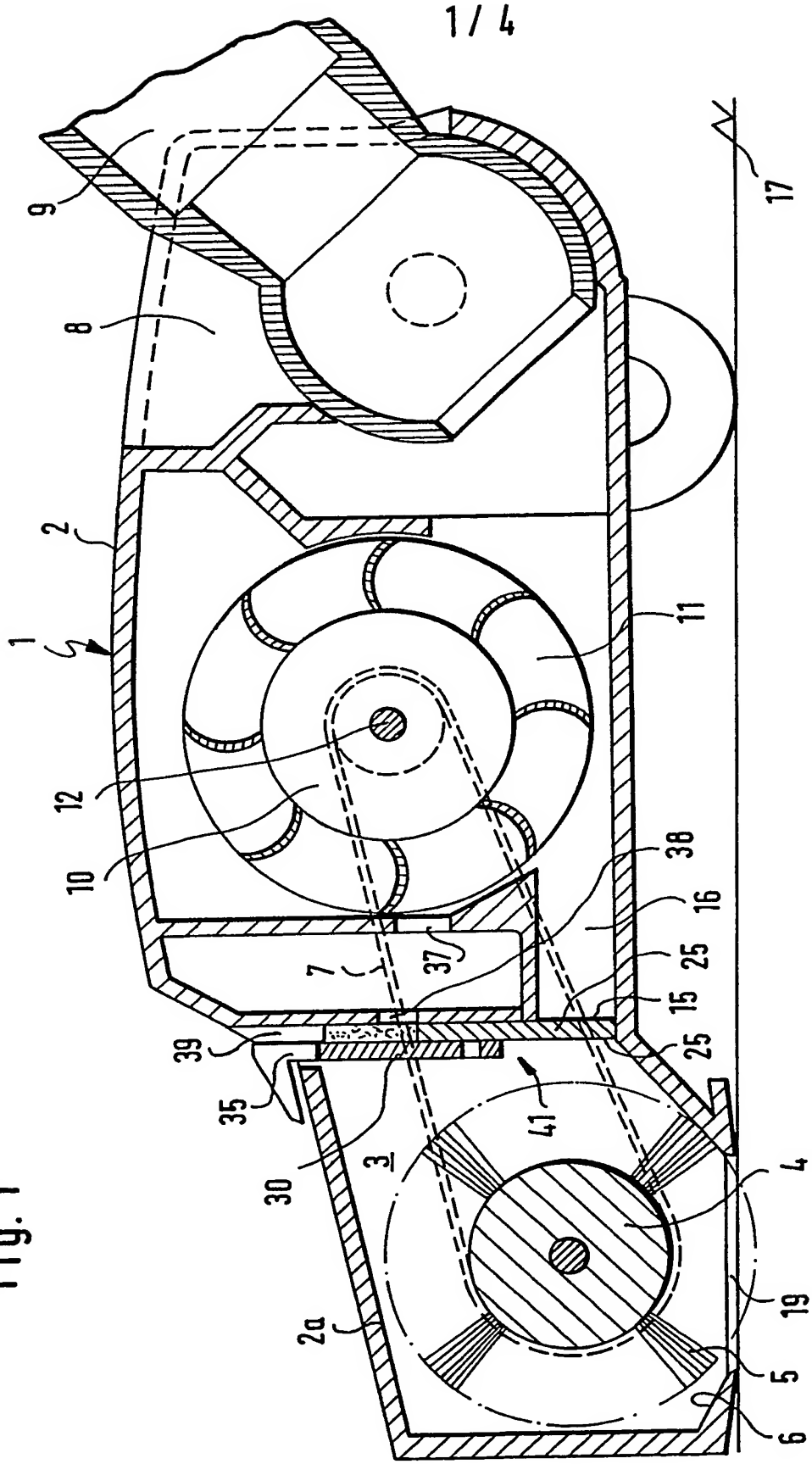
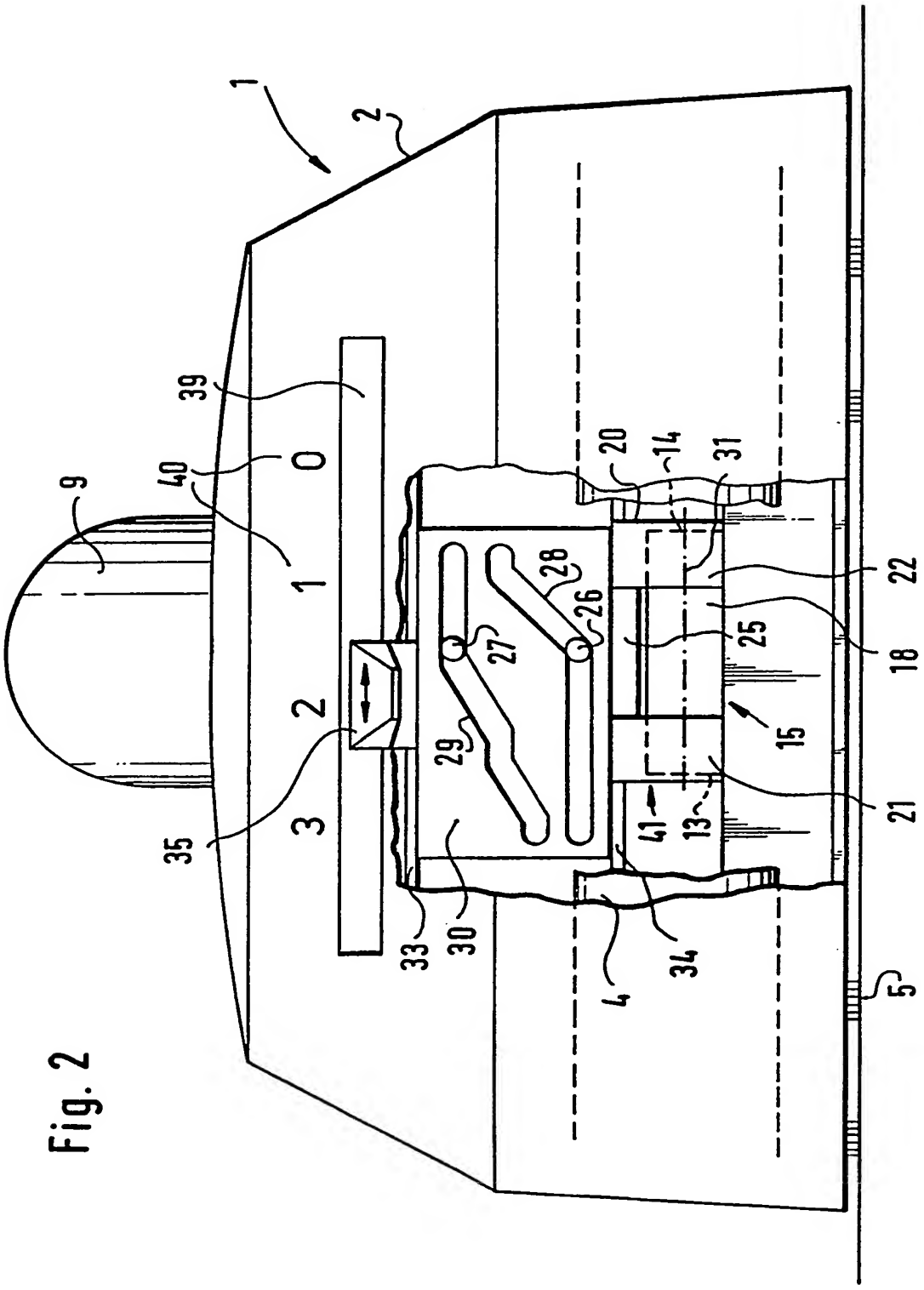


Fig. 1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18
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41
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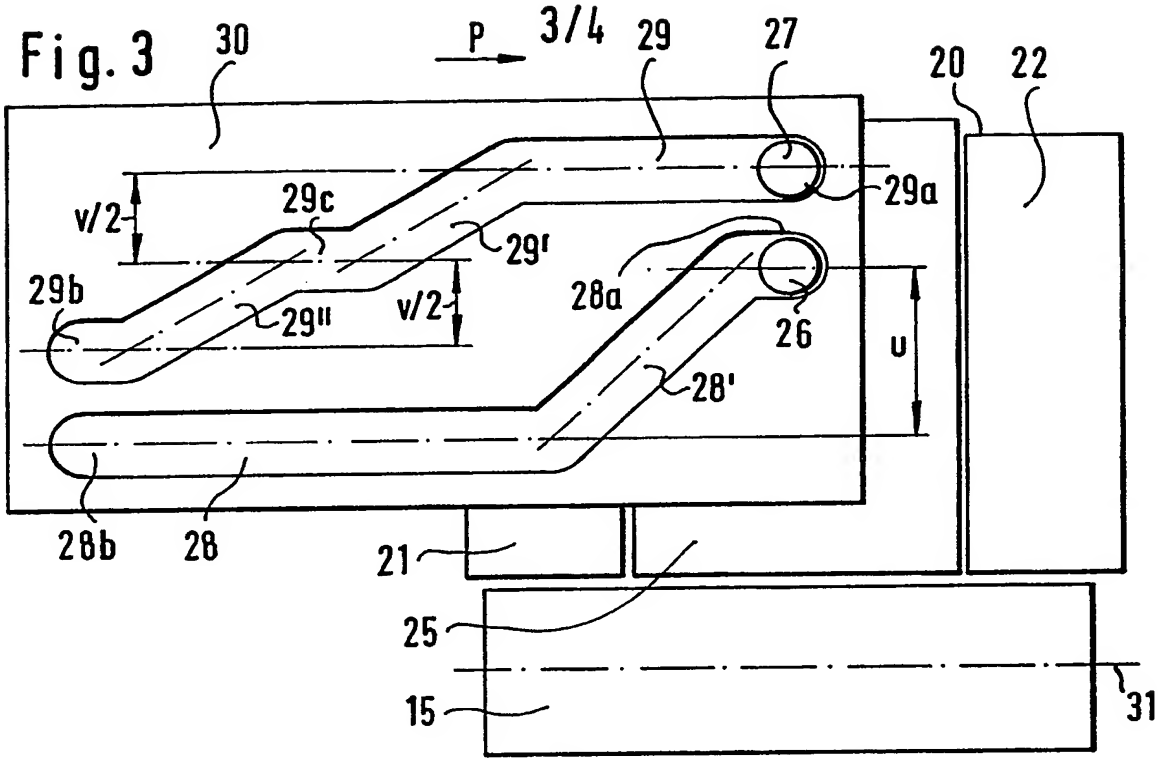
34
5

Fig. 2

Fig. 3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27
20
22
29a
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29c
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29b
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28a
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u
28'
28b
28
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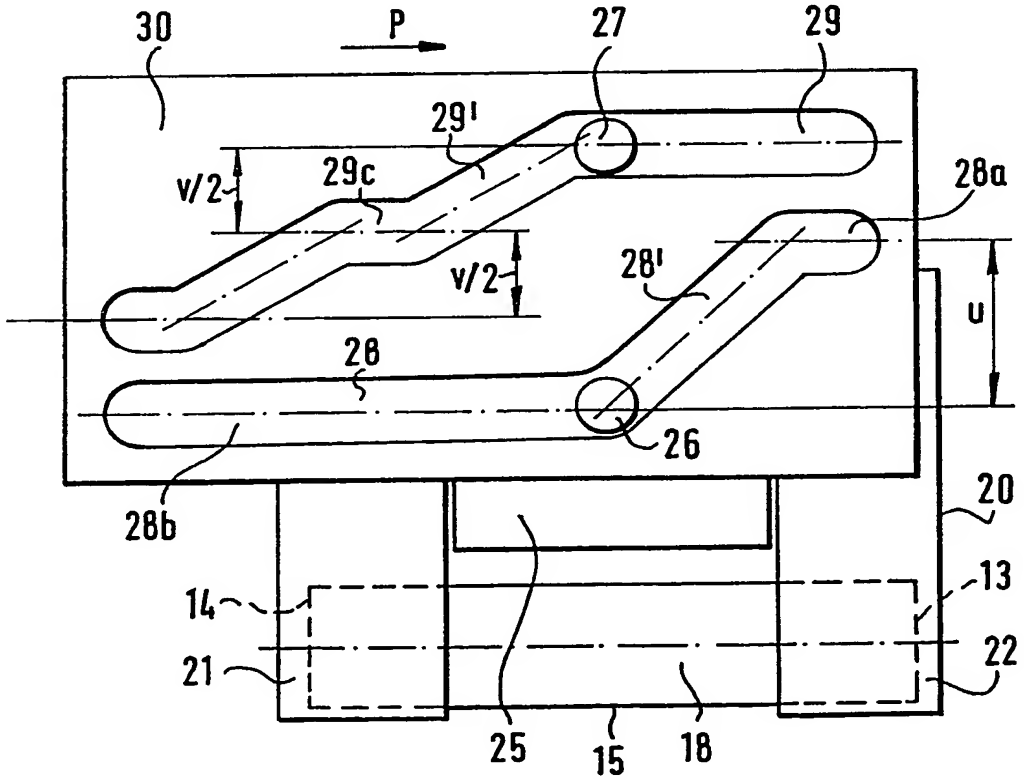
25
15
31

Fig. 4


30
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15
18

Fig.5

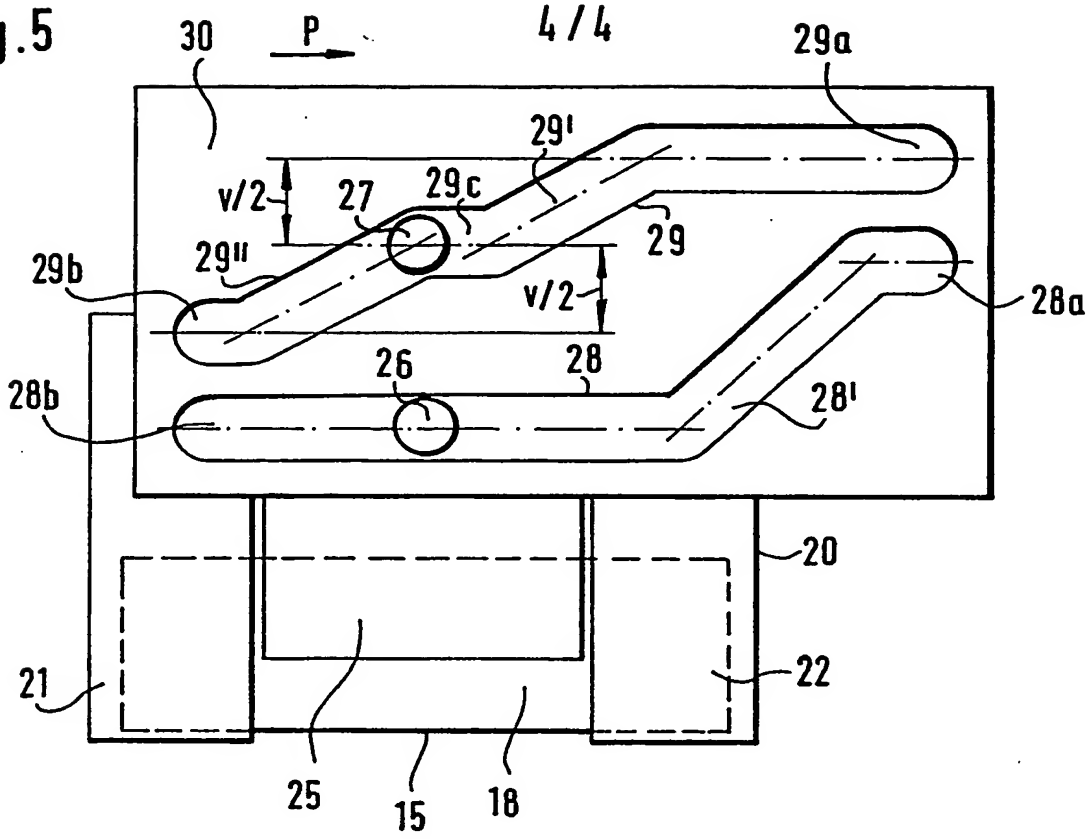
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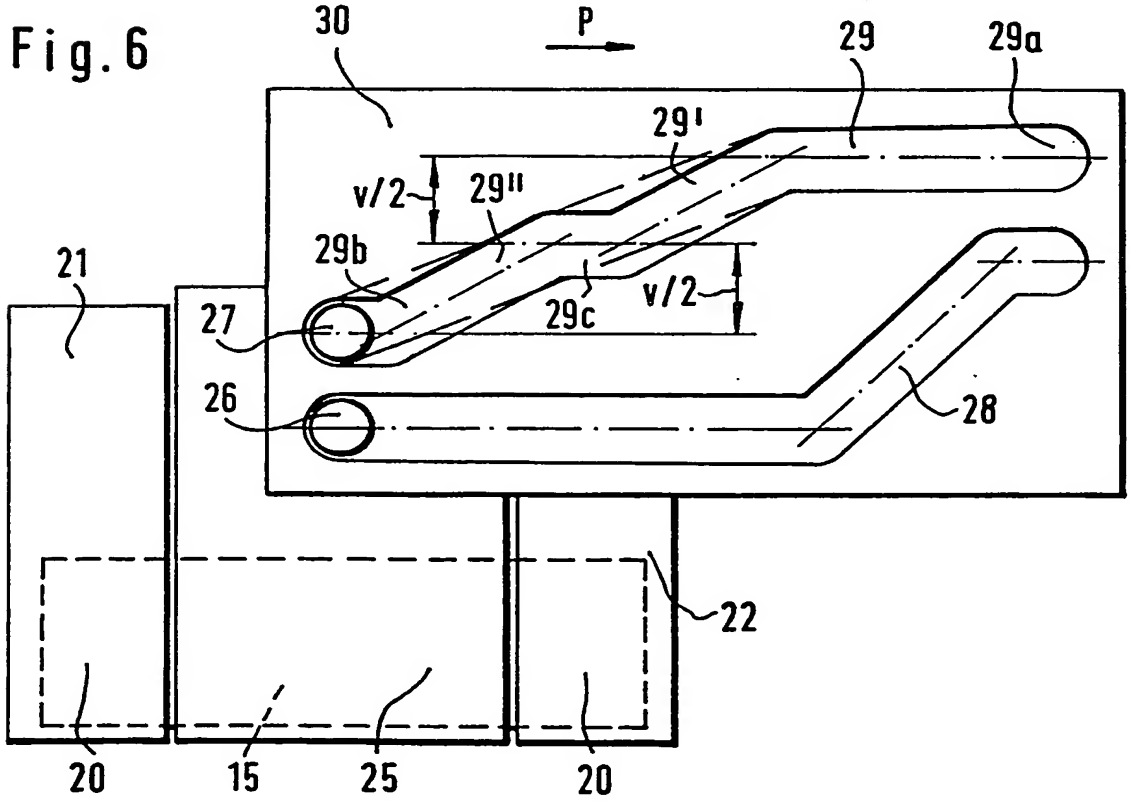
Fig.6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VACUUM CLEANING TOOL WITH ADJUSTABLE INTAKE AIR FLOW

Background of the Invention

The present invention relates to a vacuum cleaning tool having a housing, in a base of which is provided a suction or intake opening for a suction or intake air flow to a vacuum cleaner, the tool also having a brush roller, bristles of which extend through the intake opening, with the brush roller being rotatably driven via an air turbine that is driven by the intake air flow, with this intake air flow being guided from the intake opening to the air turbine and to a connector of the vacuum cleaning tool via a flow opening.

When vacuum cleaning textile floor coverings and smooth floor surfaces, in order to loosen dirt particles that adhere to the surface that is being cleaned a rotatably driven brush roller is used that is disposed in the vacuum cleaning tool, with bristles of the brush roller extending through the intake opening. To clean various textile floor coverings, and to achieve an optimum cleaning effect at maximum protection of the floor covering, the intensity of the suction or intake air flow must be adjustable, as a consequence of which the speed of the brush roller will also be altered.

It is known to adjust the intake air stream by

altering the speed of the suction fan motor via electrical or electronic adjustment means. However, this type of adjustment of the intake air stream is technically complicated and expensive, and is therefore used only for large, high-quality vacuum cleaning apparatus.

It is also known to reduce the intake air flow through the intake opening of the vacuum cleaning tool via a so-called secondary air stream. For this purpose, a manually operable adjustment device is disposed in the vacuum hose in the vicinity of the handle for opening and closing a secondary flow opening. Unfortunately, this quite simple adjustment device permits only very course adjustment of the intake air stream, which is often inadequate.

It is therefore an object of the present invention to improve a vacuum cleaning tool of the aforementioned general type in such a way that the intake air stream, and hence also the speed of the brush roller that is driven by the air turbine, can be easily and sensitively adjusted.

Brief Description of the Drawings

This object, and other objects and advantages of the present invention, will appear more clearly from the following specification in conjunction

with the accompanying schematic drawings, in which:

Fig. 1 is a cross-sectional view through one exemplary embodiment of the inventive vacuum cleaning tool at the level of a main flow opening and a secondary flow opening;

Fig. 2 is a partially broken-away front view of the vacuum cleaning tool of Fig. 1;

Fig. 3 is an enlarged view of the slide mechanism and control plate disposed in the vacuum cleaning tool, and in particular with the main flow opening completely open;

Fig. 4 is a view similar to Fig. 3 with the side slide mechanism lowered to reduce the passage cross-section of the main flow opening;

Fig. 5 is a view similar to Fig. 4, with the middle slide mechanism half way lowered; and

Fig. 6 is a view similar to Fig. 5,

with the middle slide mechanism completely lowered.

Summary of the Invention

The vacuum cleaning tool of the present invention is characterized primarily by at least one slide mechanism that is disposed in the housing for varying a passage cross-section of the main flow opening and hence for adjusting the volume of the intake air flow.

Advantageously, two slide mechanisms are provided for being able to adjust the passage cross-section of the main flow opening; these two slide mechanisms are preferably coupled with one another in an adjustment path dependent manner.

Pursuant to a further specific embodiment of the present invention, one of the slide mechanisms has two tongues that are associated with the end or side portions of the flow opening, while the other slide mechanism is associated with the central portion of the flow opening and is disposed between the tongues of the one slide mechanism. This configuration makes it possible to leave the passage height of the main flow opening unaltered after the side slide mechanism that is provided with the tongues has been lowered, so that even large dirt particles can still be drawn in without

difficulty.

By means of the slide mechanism arrangement, it is possible to completely interrupt the intake air stream through the intake opening, in which connection it is advantageous to at the same time open a secondary flow opening through which a secondary air stream flows from an intake opening to the air turbine, thereby maintaining the rotating drive for the brush roller.

Further specific features of the present invention will be described in detail subsequently.

Description of Preferred Embodiments

Referring now to the drawings in detail, the vacuum cleaning tool 1 has a housing 2 in the forward region of which is formed a brush chamber 3. Disposed in the base 6 of this brush chamber is a suction or intake opening 19 that faces the floor surface 17 that is to be cleaned; the intake opening 19 extends over the entire width of the vacuum cleaning tool 1. Disposed in the brush chamber 3, above the intake opening 19, is a brush roller 4, the bristles 5 of which project beyond the intake opening 19 and thus come into contact with the floor surface 17 that is to be cleaned.

The brush roller 4 is driven by an air turbine 10 via a belt 7; the turbine wheel 11 of the

turbine is mounted in the main housing 2 in such a way as to be rotatable about a horizontal shaft 12.

In its end or rear portion 8, which is remote from the brush chamber 3, the housing 2 of the vacuum cleaning tool 1 is provided with a pivotably mounted connector 9 via which the vacuum cleaning tool is connected to a non-illustrated vacuum cleaner.

The suction or intake air stream of the vacuum cleaning tool flows via the intake opening 19, which rests upon the floor surface 17 that is to be cleaned, into the brush chamber 3, and from there via a flow opening 15 into a flow channel 16, which conveys the intake air stream tangentially relative to the turbine wheel 11; the intake air stream then flows off to the vacuum cleaner via the connector 9. Provided parallel to the main flow opening 15 in the housing 2 of the vacuum cleaning tool 1 is a secondary flow opening 38; this secondary flow opening receives outside air via a slit-like suction or intake opening 39 that is provided in the housing 2, with the air then flowing to the connector 9 via an air inlet opening 37 and the turbine wheel 11.

To adjust the volume of the intake air stream that enters via the intake opening 19, and hence

also to adjust the speed of the air turbine 10 that drives the brush roller 4, a slide mechanism arrangement 41 is provided in the brush chamber 3 upstream of the main flow opening 15. The advantage of disposing the slide mechanism arrangement 41 upstream of the main flow opening 15 and the secondary flow opening 38 is that the slide mechanism can be pressed by the intake air stream against the rim of the flow openings 15 and 38, thus ensuring a tight closing-off without the need for additional measures.

The construction of the slide mechanism arrangement 41, which is shown in cross-section in Fig. 1, can be seen more clearly from Fig. 2. The flow opening 15 has an essentially square or rectangular cross-sectional configuration and, when seen in the front view of Fig. 2, is disposed centrally in that wall of the housing 2 that separates the housing from the brush chamber 3. The cross-sectional configuration of the flow channel 16 corresponds to that of the main flow opening 15.

The slide mechanism arrangement 41 comprises an approximately U-shaped side slide mechanism 20, the legs of which are embodied as tongues 21 and 22 for covering the side portions 13 and 14 of the

main flow opening 15. The U-shaped slide mechanism, which will subsequently be designated as the side slide mechanism 20, is held in the housing in such a way that it can be displaced vertically relative to the horizontal longitudinal central axis 31 of the main flow opening 15.

Provided between the tongues 21 and 22 of the side slide mechanism 20 is a middle slide mechanism 25, which in order to close off the central portion 18 of the main flow opening 15 is held in the housing in such a way as to be displaceable vertically relative to the longitudinal central axis 31 of the main flow opening 15. Via respective pins 26 and 27, the two slide mechanisms engage in respective guide slots 28 and 29 of a control plate 30, which is mounted in the housing in such a way as to be displaceable in guide rails 33 and 34 in the direction of the longitudinal central axis 31 of the main flow opening 15. The control plate 30 is provided with a grip member 35 that extends out through a slot that forms the intake opening 39 for the secondary flow opening 38. Associated with the grip member 35 are adjustment marks 40 that are provided on the housing.

In the open position of the main flow opening

15 shown in Fig. 3, the two slide mechanisms 20 and 25 are disposed above the opening 15. In relation to the main flow opening 15, the middle slide mechanism 25, in its "open position", completely uncovers the main flow opening 15; at the same time, however, in the open position of the main flow opening 15 the middle slide mechanism 25 closes off the secondary flow opening 38, as shown by broken lines in Fig. 1. In this position illustrated in Fig. 3, the pin 26 of the side slide mechanism 20, and the pin 27 of the middle slide mechanism 25, are disposed in end portions 28a and 29a of the guide slots 28 and 29 respectively. These end portions 28a and 29a are disposed essentially parallel to the longitudinal central axis 31 of the main flow opening 15. The vertical or height positions of the end portions 28a and 29a of the guide slots 28 and 29 determine the open positions of the side slide mechanism 20 and the middle slide mechanism 25 illustrated in Fig. 3.

The end portion 28a of the guide slot 28 has a horizontal dimension that essentially corresponds to the diameter of the guide pin 26. The other end portion 28b of the guide slot 28 is disposed parallel to the end portion 28a, but is lower by the vertical distance "u", which corresponds to the

stroke or travel of the side slide mechanism 20 from its open position shown in Fig. 3 to its closed position shown in Figs. 4 to 6. The two horizontal end portions 28a and 28b merge with one another via an inclined portion 28'.

When viewed from the top, the horizontal end portion 29a of the guide slot 29 that is associated with the middle slide mechanism 25 has a length that corresponds approximately to the length of the end portion 28a plus the inclined portion 28'. When the control plate 30 is moved in the direction of the arrow P, the pin 27 is guided in the horizontal end portion 29a, as a result of which the middle slide mechanism 25 remains in its open position. In contrast, after a short adjustment path of the control plate 30, the pin 26 of the side slide mechanism 20 leaves the end portion 28a and enters the inclined portion 28', being shifted by the distance "u" until it reaches the lower horizontal end portion 28b, as a result of which the side slide mechanism 20 is displaced into its closed position illustrated in Fig. 4. Whereas the side slide mechanism 20 in the closed position shown in Fig. 4 has thus closed off the end or side portions 13 and 14 of the main flow opening 15, the middle slide mechanism 25 maintains its open

position, in which it closes off the secondary flow opening 38. The passage cross-section of the main flow opening 15 is reduced by the side portions 13 and 14 that are covered by the tongues 21 and 22 of the side slide mechanism 20; in conformity with the reduced intake air stream, the drive speed of the air turbine 10 is reduced, so that the brush roller 4 rotates more slowly. The height of the main flow opening 15 advantageously remains unaltered, so that larger dirt particles that are drawn-in with the reduced volume intake air stream are also reliably withdrawn via the reduced passage cross-section of the main flow opening. In the illustrated embodiment, the tongues 21 and 22 cover somewhat less than half of the width of the main flow opening 15, so that the passage cross-section is reduced by about 40%.

If the control plate 30 is shifted further out of the position shown in Fig. 4 in the direction of the arrow P, the guide pin 27 of the middle slide mechanism 25 enters a first inclined portion 29', which connects the horizontal upper end portion 29a with a horizontal intermediate portion 29c in the vertical direction. The intermediate portion 29c is lower than the upper end portion 29a by the distance v/2. Whereas during the adjustment

movement of the control plate 30 in the direction of the arrow P, the pin 27 is conveyed via the inclined portion 29' into the intermediate portion 29c, the pin 26 of the side slide mechanism 20 is disposed in the lower horizontal end portion 28b, which fixes the closed position of the side slide mechanism 20.

The half closed position of the middle slide mechanism 25 illustrated in Fig. 5 results when the pin 27 of the middle slide mechanism 25 is positioned in the intermediate portion 29c. The downward stroke or travel of the middle slide mechanism 25 corresponds to the amount v/2. The central portion 18 of the main flow opening 15 is reduced to half of the passage height. The intake air stream as well as the speed of the brush roller are further reduced. In this half open position of the middle slide mechanism 25 illustrated in Fig. 5, the secondary flow opening 38 (Fig. 1) is partially opened, so that in addition to the minimal intake air stream for driving the air turbine 10 via the flow channel 16, a secondary air flow is built up via the intake opening 39, the secondary flow opening 38, and the air inlet opening 37 for driving the air turbine 10. Thus, the drive of the air turbine 10 that is reduced

during minimal vacuum cleaning effect by the minimal intake air stream is partially compensated for in order to make an adequate torque available at the brush roller 4.

If the control plate 30 is shifted further in the direction of the arrow P, the guide pin 27 of the middle slide mechanism 25 is transferred via a further inclined portion 29" from the intermediate portion 29c into the horizontal end portion 29b, thereby carrying out the second half stroke v/2. In this position, which is illustrated in Fig. 6, the guide pins 26 and 27 are disposed at the back ends of the guide slots 28 and 29, as a result of which the main flow opening 15 is completely closed. The intake air stream from the intake opening 19 to the connector 9 for carrying off loosened dirt particles is interrupted.

In the closed position of the middle slide mechanism 25 of Fig. 6, the secondary flow opening 38 is completely opened, as shown in Fig. 1, so that via the intake opening 39, the secondary flow opening 38, and the air inlet opening 37 an unrestricted secondary air stream flows into the housing 2 for driving the air turbine 10. This ensures that even when the main flow opening 15 is closed, a rotating drive of the brush roller 4 is

effected, so that for example a textile floor covering or the like can be brushed to improve the visual effect.

The aforementioned adjustment marks 40 on the housing are associated with the positions of the control plate 30. In the completely closed position of the main flow opening 15 (Fig. 6), the grip member 35 of the control plate 30 is located exactly at the mark "0". When the grip member 35 is shifted to the mark "1", the slide mechanism arrangement 41 assumes the position shown in Fig. 5, where the central portion 18 of the main flow opening 15 is opened half way.

If the grip member 35 is located at the mark "2" (Figs. 2, 4), the central portion 18 of the main flow opening 15 is completely opened. By shifting the grip member 35 to the mark "3", the main flow opening 15 is then completely opened, as shown in Fig. 3.

As already described above, in the position "0", the secondary flow opening 38 is completely opened, whereas when the slide mechanism arrangement 41 is set at the mark "1", the secondary flow opening is partially opened. At the setting "2", the secondary flow opening 38 is completely closed.

Rather than carrying out the displacement of the slide mechanisms in stages, it can also be expedient to effect such displacement in an infinitely variable manner. For this purpose, for example, the end portion 29a can merge with the lower end position 29b, which determines a closed position, via an inclined portion that is illustrated by dashed lines in Fig. 6. The important thing for the configuration of the guide slot 29 is that the one slide mechanism (for example the middle slide mechanism 25) can be lowered for closing off the flow opening only when the other slide mechanism (for example the side slide mechanism 20) has at least approximately reached its closed position. In particular applications, it can be advantageous to synchronously move both slide mechanisms or to separately adjust each slide mechanism via a suitable adjustment arrangement.

The present invention is, of course, in no way restricted to the specific disclosure of the specification and drawings, but also encompasses any modifications within the scope of the appended claims.

WHAT I CLAIM IS:

1. In a vacuum cleaning tool having a housing, in a base of which is provided an intake opening for an intake air flow to a vacuum cleaner, said tool also having a brush roller, bristles of which extend through said intake opening, with said brush roller being rotatably driven via an air turbine that is driven by said intake air flow, and with said intake air flow being guided from said intake opening to said air turbine and to a connection of said tool via a main flow opening, the improvement comprising:

at least one slide mechanism that is disposed in said housing for varying a passage cross-section of said main flow opening and hence for adjusting the volume of said intake air flow.

2. A vacuum cleaning tool according to claim 1, which includes two slide mechanisms for varying said passage cross-section of said main flow opening.

3. A vacuum cleaning tool according to claim 2, in which said two slide mechanisms are coupled with one another in an adjustment path dependent manner.

4. A vacuum cleaning tool according to claim 2, in which a first one of said slide mechanisms

has two tongues that are associated with side portions of said main flow opening, while a second one of said slide mechanisms is associated with a central portion of said main flow opening and is disposed between said tongues of said first slide mechanism.

5. A vacuum cleaning tool according to claim 4, in which said slide mechanisms are mounted so as to be vertically displaceable relative to a horizontal central axis of said main flow opening.

6. A vacuum cleaning tool according to claim 4, which includes a common control plate for operating said slide mechanisms, with said control plate being displaceably mounted in said housing and being provided with a grip member that extends out of said housing.

7. A vacuum cleaning tool according to claim 6, in which said control plate is mounted in said housing so as to be displaceable in the direction of a horizontal central axis of said main flow opening.

8. A vacuum cleaning tool according to claim 6, in which said control plate is provided with guide slots, and said slide mechanisms are provided with guide pins for holding and guiding said slide mechanisms in said guide slots of said control

plate.

9. A vacuum cleaning tool according to claim 8, which includes a controllable secondary flow opening that is disposed parallel to said main flow opening, with a secondary air flow flowing from a further intake opening through said secondary flow opening and to said air turbine.

10. A vacuum cleaning tool according to claim 9, in which adjustment of a passage cross-section of said secondary flow opening is a function of adjustment of said passage cross-section of said main flow opening such that with said main flow opening open said secondary flow opening is closed, with said main flow opening partially closed said secondary flow opening is partially open, and with said main flow opening completely closed said secondary flow opening is completely open.

11. A vacuum cleaning tool according to claim 10, in which an adjustment slot in said housing through which said grip member extends forms said further intake opening for said secondary air flow.

12. A vacuum cleaning tool according to claim 10, in which said second slide mechanism is a middle slide mechanism in the form of a closure member for controlling said passage cross-sections of said main flow opening and said secondary flow

opening.

13. A vacuum cleaning tool according to claim 2, in which one of said slide mechanisms is a side slide mechanism and the other is a middle slide mechanism, with said slide mechanisms being coupled with one another as a function of their position such that said middle slide mechanism is lowerable only after complete lowering of said side slide mechanism.

14. A vacuum cleaning tool according to claim 6, in which said slide mechanisms and said control plate are disposed in a brush chamber of said housing for said brush roller upstream of said main flow opening.

15. A vacuum cleaning tool substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number
9204338.9

Relevant Technical fields

(i) UK Cl (Edition K) A4F

(ii) Int CL (Edition 5) A47L

Search Examiner
G HEMSLEY

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search
21 APRIL 1992

Documents considered relevant following a search in respect of claims 1-15

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 2154432 A (VORWERK) - page 1 lines 26-40	1
X	EP 0338780 A (MATSUSHITA) - column 3 lines 8-49	1

tp - c:\wp51\doc99\fil000453

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

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P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

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